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Southern Region SARE

Project Title:

Accountability at local, state, and federal levels for impacts of agricultural conservation practices on water quality.

Project Coordinator:

Dr. Dwight S. Fisher, Rangeland Scientist
J. Phil Campbell, Sr., Natural Resource Conservation Center
1420 Experiment Station Road
Watkinsville, GA 30677-2373

Telephone: (706) 769-5631 ext. 268
FAX: (706) 769-8962
Email: Dwight_Fisher@Scientist.com

Abstract

Recent legislation requires that evaluation of conservation programs be based on improvements in natural resources and not on how frequently a conservation practice is adopted. Producers and those establishing and implementing policy need methods for assessing outcomes of conservation practices that are both economically feasible and scientifically defensible. We propose using the Upper Oconee River Basin in North Georgia as a model for developing assessment criteria. Sampling strategies with alternative data, timing, and spatial distributions will be evaluated and the best strategies extended for use by local, state, and federal agencies for the benefit of producers and the public.

Statement of Problem, Rationale, and Significance

Conservation provisions of the 1996 Farm Bill have introduced increased local control of problem identification and prioritization. The Bill also broadened natural resource issues to address soil, water, wetlands, wildlife, and species preservation concerns while mandating programs to support animal based agriculture and grazing lands management (Zinn, 1997). Through the Soil and Water Conservation Districts, Local Work Groups were convened to identify high priority natural resource problems and propose solutions using the Environmental Quality Improvement Program (EQIP). The EQIP combines functions of the Agricultural Conservation Program, Water Quality Incentives Program, Great Plains Conservation Program, and the Colorado River Basin Salinity Control Program. In addition, under the Government Performance Reform Act, all federal agencies must develop new methods of evaluating outcomes of their activities (Zinn, 1997). Historically, agencies providing technical support to conservation programs have been evaluated based on numbers of clients served, numbers of plans written, miles of a practice installed, etc. A rational basis for gauging progress that provides an index of ecosystem health is essential for working with non-point sources of pollution (Courtemanch, 1994; Hart, 1994). Congress wants evaluation of conservation programs to be based on measurements relating to the quality of air, water, and soil resources, and on numbers and diversity of wildlife and at-risk species.

Pressure is also increasing on the Environmental Protection Agency (EPA) and associated state agencies to improve water quality under the provisions of the 1972 Clean Water Act. In Georgia, a recent settlement of a law suit by the Sierra Club, Trout Unlimited, and others will require that the state Environmental Protection Division (EPD) set pollution limits in Georgia's 14 river basins over the next 8 years (Soto, 1997; Editor, 1997). Nearly 600 waterways in Georgia have been identified as impaired and each of those waterways requires a plan to establish Total Maximum Daily Loads (TMDL) for various pollutants. There are major non-point sources of pollutants in many waterways and agricultural sources are included. The types of water quality problems being identified by the EQIP Local Work Groups under the 1996 Farm Bill are of great concern to the EPD and EPA, as relates to the water quality standards.

As the EPA and EPD develop water quality standards for lakes and steams, agricultural producers may be identified as contributing to impairments and charged to reduce their inputs to acceptable levels. The agricultural community claims that voluntary conservation practices and appropriate management can reduce impairments to waterways. However, except for sediments and some nutrients there are few data to support this claim. For example, the effects of conservation practices on levels of fecal coliform bacteria that might be associated with animal based agriculture are relatively unknown. Intensification of agricultural systems has increased agricultural impacts off the farm and increased the importance of developing effective means of creating sustainable agricultural systems (Matson et al., 1997). However, from the 1970s until 1992, less than 0.2% of the $500 billion spent through the Clean Water Act was spent to test for effectiveness of abatement programs (Hart, 1994).

The proposed site for the project is the upper Oconee River Basin of Georgia in the Southern Piedmont physiographic region. The headwaters of the Oconee River are in southern Hall County, GA. The Oconee basin continues through the mid-Piedmont to Athens, which serves as a major regional city. South of Athens, the Oconee River flows through predominantly agricultural watersheds to Lake Oconee. The lake is a Georgia Power reservoir located near the beginning of the Sand Hills. Lake Oconee provides hydroelectric power, real estate development, and recreation for a large region including Atlanta. Below Lake Oconee, the river continues through the Sand Hills to the Coastal Plain physiographic region where it merges with the Ocmulgee River to form the Altamaha River that flows to the Atlantic Ocean. A natural expansion of the project to include additional watersheds (Oconee, Ocmulgee, and Altamaha River Basins) could be explored once work in the upper Oconee was established and additional collaborative partnerships could be established.

In the proposed research area, animal-based agricultural provides by far the largest agricultural income and many processing jobs in the communities. Many animal production systems use imported feeds with various manure disposal strategies that could lead to nutrient enrichment and degradation of watersheds. Changes in land use may also result in loss of farmland, fragmentation of habitat, and decreased populations of at-risk species (Dobson, et al., 1997). Agricultural concerns include competition for land and water as well as avoiding new regulations. The agricultural sector has also been negatively impacted by the decline of rural economies and low income to many farm families. This has been accompanied by the conversion of rural economies to non-agricultural activities accompanied with loss of agricultural services and suppliers. All sectors of the economy are concerned about water-related issues such as recreation, tourism, safety of the water supply as related to human health and the effects of water quality on fishing, real estate values, and wildlife habitat.

Methods that are both cost-effective and scientifically defensible for evaluation of such broad based natural resource programs as those initiated under the 1996 Farm Bill or those that might be mandated to achieve TMDL levels for impaired watersheds have not been adequately defined. We propose activities that bring researchers and educators together with Local Work Groups, Soil and Water Conservation Districts, state and federal agencies, and non-governmental organizations to develop better evaluation tools and methodologies for local use. Involvement of lead farmers and farm groups, often through their involvement in the Local Work Groups, will be essential to success of our goals. "Each owner's actions are important, not just because they affect that particular piece of land, but also because they affect neighboring land and the health of the larger ecosystems and watersheds in which they occur" (USDA, 1996).

Objectives

The proposed SARE project would address the following specific objectives:

1) Through interaction with the Local Work Groups charged with prioritizing EQIP projects in the Upper Oconee River Basin, we will establish strategically located sampling sites in watersheds receiving EQIP funding prior to the implementation of conservation practices, and

2) while compiling baseline data in the upper Oconee River Basin we will develop cost-effective and scientifically defensible sampling strategies for local, state, and federal evaluation of outcomes of EQIP funded conservation and best management practices.

Approach and Methods

Objective 1: Watersheds in the Upper Oconee Basin with impaired water quality will be identified through interactions with Local Work Groups charged with identifying priority problems and solutions to be supported by EQIP funding. These priority problems and solutions will be used to rank watersheds and, along with GIS analysis, be used to identify watersheds and strategic sites within watersheds for intensive monitoring of water quality. Sampling will be conducted during the expenditure of EQIP funds and will be continued throughout the installation of conservation practices. Strategies developed within EQIP for remediation of water quality degradation will be evaluated for their effectiveness within these selected sites using a time series analysis (Izuno et al., 1996; Tremwell et al., 1996).

Objective 2: Alternative analytical and sampling methods will be evaluated on the Research Center and at selected watersheds to develop sampling and analytical strategies that are cost efficient and scientifically sound.

Research Located on the USDA Research Center at Watkinsville: Cattle will be removed from portions of degraded riparian zones and be allowed limited access to riparian zones at replicated sites on the Research Center with water quality sampling at sites above and below each riparian treatment site. Water quality will be monitored for ammonium, nitrate, phosphorus, dissolved oxygen, temperature, conductivity, pH, turbidity, and fecal coliform bacteria. Estimates of plant species diversity as the zones are rehabilitated will be made monthly using transects. Degraded sites will be compared with adjacent control sites that have

not been exposed to cattle. The exclusion of cattle from riparian zones will be integrated with research into alternative management strategies for cattle production.

Replicated buffer strips will be planted on waterways draining miniature watersheds and water samples collected during run off events will be tested for ammonium, nitrate, phosphorus, pH, turbidity, and fecal coliform bacteria. These data will be evaluated in concert with records of animal movements.

Watershed Research: Sampling sites strategically located using GIS technology in the watersheds identified in Objective 1 will be established and automatic sampling equipment installed. This approach requires the development of a GIS database at sufficient resolution to determine individual field contributions of pollutants to streams and with appropriate data layers including topography, soils, hydrography, wetlands, land cover, farm and field locations, and animal farm operations. This database can then be used for sample site location and subsequent spatial analysis. Data loggers will automatically monitor ammonium, nitrate, phosphorus, dissolved oxygen, temperature, and pH. Samples for analysis of turbidity and fecal coliform bacteria will be collected weekly. Combinations of chronologically based and event based sampling will be tested. Land use patterns will also be associated with water quality and used to identify important non-point source pollution problems. The results of this intensive sampling work both at Watkinsville and out on the watersheds will be used to design sampling methods based upon both economics and scientific validity (Abtew et al., 1997).

Information Dissemination and Outreach Plan:

Research results will be communicated through Experiment Station Field Days and Tours. Some of the areas available for riparian zone restoration research are located near roads and signs will be installed to indicated progress by briefly summarizing the work. In addition, results will be communicated via newsletters and reports to the Local Work Groups and through presentations and publications in scientific meetings and journals.

Through the Sustainable Agriculture Training Coordinator of the Georgia Cooperative Extension Service, statewide training projects will be developed. This component will also provide skills in on-farm training, FARM*A*SYST, and the agricultural pollution prevention database.

The participation of the SANREM-CRSP provides strong linkages to rural sociology, anthropology, and community. The SANREM-CRSP will provide expertise in outreach activities and educational materials. This broad-based partnership will be used to build bridges through Local Work Groups to producers to communicate priority conservation practices and land use hazards in watersheds. The linkage with on-going international watershed research sites will provide a unique mechanism for information exchange that benefits both domestic and developing country policy and local groups dealing with similar issues.

Evaluation

The proposed program will utilize a framework based on performance for evaluation of effectiveness. Our framework will be used to identify the proposed outputs and potential impacts of the work to be done. This will include predetermined "indicators of success" for outputs and impacts and a timeline that will be evaluated semi-annually (Bennett, 1996). The program partners will do this for the technical work as well as measures of collaboration and any changes in practice. Additionally, participatory evaluation will be a critical part of the

evaluation (Aaker and Shumaker, 1994; Narayan, 1993). Participatory evaluation allows for the diverse stakeholders to identify early in the program "how they will know" that the program is succeeding. Through regular meetings, the stakeholders will provide input on what is working well, what is working less well, and what actions need to be taken to make the program better. This allows for a greater ownership of the program by all the parties/stakeholders involved. Finally, the evaluation component will include process documentation. We will document the process of the program including lessons learned and recommendations for improvement through out the program. Through this three tiered approach, we feel that we will be able to show that we did what we said we would do, that the program was constantly self-assessed and that the process was documented and therefore repeatable.

Project Investigators and Participants

Coordinator

D.S. Fisher	Rangeland Scientist, USDA-ARS, Watkinsville, GA

Co-Coordinators

C.L. Neely	Assistant Program Director, SANREM/UGA, Watkinsville, GA
J.L. Steiner	Agric. Climatologist and Res. Leader, USDA-ARS, Watkinsville, GA

Co-Investigators

Dinku Endale	Hydrologist, USDA-ARS, Watkinsville, GA
A.J. Franzluebbers	Soil Ecologist, USDA-ARS, Watkinsville, GA
J.E. Houston	Economist, University of Georgia, Athens, GA
L. M. Risse	Extension Agricultural Engineer, University of Georgia, Athens, GA
H.H. Schomberg	Crop Ecologist, USDA-ARS, Watkinsville, GA
J.A. Stuedemann	Animal Scientist, USDA-ARS, Watkinsville, GA
E.L. Usery	Geographer, University of Georgia, Athens, GA

Producers and Natural Resource Organizations

T. Bell	Pres., Oconee River Resource Cons. and Dev. Area, Inc., Watkinsville, GA
E.E. Brantley, Jr.	Area Conservationist, USDA-NRCS, Watkinsville, GA
T.D. Cheek	Lake Resources Manager, Georgia Power, Eatonton, GA
E. Cosby	State Conservationist, USDA-NRCS, Athens, GA
F. Henning	Special Extension Agent, Water Quality, Madison, GA
D.H. Jackson	Chairman, Oconee River Soil and Water Cons. District, Winder, GA
F.G. Liles, Jr.	Exec. Dir., Georgia Soil and Water Conservation Commission
D. Perkins	Cattle producer, Winder, GA

Investigator and Participant Role

Coordinator

Dwight Fisher - Dr. Fisher is a Rangeland Scientist at the J. Phil Campbell Senior Natural Resource Conservation Center, in Watkinsville GA with experience in grazing systems and mathematical modeling. Dr. Fisher is responsible for whole farm planning at the USDA-ARS Research Center at Watkinsville. The ARS research program at Watkinsville takes an interdisciplinary approach to problem solving and we are addressing issues of informed decision making at the whole farm level and interface of agricultural practices with other activities in watersheds using simulation, GIS, and information management technologies to achieve these goals. Dr. Fisher will coordinate research site maintenance and incorporation of conservation practices within the context of the entire grazing system. He will contribute to educational programs in plant and animal interactions and animal impacts on water quality.

Co-Coordinators

Constance Neely - Dr. Neely is the Assistant Program Director of the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP). Her training is in agroecosystems and she has experience both domestically (USDA-NRCS) and internationally (USAID) in the development and implementation of natural resource management strategies. She has experience in working with interdisciplinary and inter-sectoral (government, university, non-government, and community) teams. She leads the participatory monitoring and evaluation efforts for the SANREM CRSP. Dr. Neely will co-coordinate the project with Drs. Fisher and Steiner.

Jean Steiner - Dr. Steiner is Research Leader and Director at the J. Phil Campbell Senior Natural Resource Conservation Center and has experience studying soil and plant microenvironments. Dr. Steiner will contribute to team building, research planning and research sampling strategies, new monitoring methods, and comparisons of efficiencies of alternative methods. Dr. Steiner will co-coordinate the project with Drs. Fisher and Neely.

Co-Investigators

Dinku Endale - Dr. Endale is a Hydrologist at the J. Phil Campbell Senior Natural Resource Conservation Center. Dr. Endale will provide expertise in hydrologic flows relevant to the watersheds under study.

A.J. Franzluebbers - Dr. Franzluebbers is a Soil Ecologist at the J. Phil Campbell Senior Natural Resource Conservation Center. Dr. Franzluebbers will provide expertise on soils aspects of the land use patterns in the experimental watersheds.

J.E. Houston - Dr. Houston is an economist in the Department of Agricultural and Applied Economics of the University of Georgia. He has experience with the determination of the acceptability and trade-offs of cost-sharing best management practices and has a comprehensive background in production, marketing, and natural resources economics. Dr. Houston will assist in evaluation and documentation of the impact of EQIP expenditures on conservation practices.

L.M. Risse - Dr. Risse is an Agricultural Engineer in charge of preventing agricultural pollution with the University of Georgia. Dr. Risse will provide assistance in relating the database to farming operations such as land applications of waste.

H.H. Schomberg - Dr. Schomberg is a Crop Ecologist at the J. Phil Campbell Senior Natural Resource Conservation Center. Dr. Schomberg will provide expertise in the integration of field crops with animal agriculture in the watersheds and the impact of field crops on water quality.

J.A. Stuedemann - Dr. Stuedemann is an Animal Scientist at the J. Phil Campbell Senior Natural Resource Conservation Center. Dr. Stuedemann will provide expertise in characterizing animal management and production practices as related to the methodologies evaluated to assess the impact of various conservation practices.

Lynn Usery - Dr. Usery is a member of the Geography Department at the University of Georgia. Dr. Usery has extensive experience developing GIS databases and in the utilization of GIS for description and modelling of watersheds, sources of pollutants, water quality, and spatial analysis. Dr. Usery would bring these skills, along with research results from other portions of the state, to the research team and assist in development of the geographic description of the researched watersheds.

Producers and Natural Resource Organizations

Tom Bell - Mr. Bell is President of the Oconee River Resource Conservation and Development Area, Inc. The Oconee River RC&D Council will be instrumental in the identification of priority areas and producer cooperators in the watersheds of interest.

Earl Brantley - Mr. Brantley is the USDA-NRCS Area Conservationist in our study area. Mr. Brantley will provide essential links to the Local Work Groups in priority setting and helping characterize the resource base by providing access to NRCS databases.

T. David Cheek - Mr. Cheek is the Lake Resources Manager, Georgia Power and will bring the industry perspective to the planning process. Georgia Power's operations on Lake Oconee give them a vested interest in the water quality produced by the Upper Oconee Basin.

Earl Cosby - Mr. Cosby is the State Conservationist with USDA-NRCS and provides a vital link to the Natural Resources Conservation Service activities in Georgia. Interaction with the NRCS will help establish priorities in the location and installation of conservation practices.

Frank. Henning - Mr. Henning is the Special Extension Agent with responsibilities for water quality in the Little River/Rooty Creek watershed located in parts of Morgan, Putnam, Jasper, Walton, and Newton Counties. Mr. Henning will be involved in the planning and outreach activities of the project.

David Jackson - Mr. Jackson is Chairman of the Oconee River Soil and Water Conservation District. The conservation district supervisors will provide local input on priorities from local work groups in Barrow, Clarke, Jackson, and Oconee Counties.

Graham Liles - Mr. Liles is Executive Director of the Georgia Soil and Water Conservation Commission and has a great interest in the efficacy of best management practices. Mr. Liles will also be involved in identification of priority areas and producer cooperators.

D. Perkins - Mr. Perkins is the Owner and Operator of the Dove Creek Farm in Winder, GA. Mr. Perkins will serve as a lead producer for representing the point of view and needs of the cattlemen located in the watershed. Mr. Perkins is outgoing President of Clarke-Oconee Cattlemen's Association and was runner-up for the Southern Region, National Association of Conservation Districts, Educator of the Year Award.

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